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Engineering Technician Series

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NOTE

This standard has been converted from the original paper format to electronic format without substantive change in series coverage or grading criteria. The standard was reviewed to correct errors that may have been introduced during the conversion process. In some standards minor corrections were made such as updating references to other documents that may have become obsolete, or correcting minor typographical errors in the original standard. Any errors that remain due to conversion to electronic format should be minor and are not intended to change the meaning of the original standard.

If you find page references near the right hand margin of this standard they indicate the pagination of the official, printed version of this standard. For example, a notation "PAGE 2, 4/88, TS-87" would mean that (1) page two of the printed version begins here, (2) the date of issuance was 4/88, and (3) the Transmittal Sheet number was TS-87.

Engineering Technician Series

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SERIES DEFINITION

This series includes technical positions that require primarily application of a practical knowledge of (a) the methods and techniques of engineering or architecture; and (b) the construction, application, properties, operation, and limitations of engineering systems, processes, structures, machinery, devices, and materials. The positions do not require professional knowledges and abilities for full performance and therefore do not require training equivalent in type and scope to that represented by the completion of a professional curriculum leading to a bachelor's degree in engineering or architecture. Excluded from this series are positions that are specifically covered by a more specialized technical series.

This standard supersedes the standard for the Engineering Technician Series, GS-802, which was issued in December 1960 and amended in April 1966.

RELATIONSHIP TO OTHER OCCUPATIONS

The Engineering Technician Series, GS-802, is a composite, general series for nonprofessional technical positions in the Engineering and Architecture Group, GS-800, that are not specifically covered by other series. Thus, the Engineering Technician Series includes positions performing nonprofessional technical work in functions such as research, development, design, evaluation, construction, inspection, production, application, standardization, test, or operation of engineering facilities, structures, systems, processes, equipment, devices or materials. The functions involve the solution of technical problems that require primarily application of a practical knowledge of the methods and techniques by which materials, natural resources, and power are made useful.

Other related kinds of positions are discussed below:

1. Positions requiring professional competence in engineering

Such positions are included in the appropriate professional series in the Engineering and Architecture Group, GS-800. The distinctions between professional and nonprofessional technical work are discussed in the standards for various professional series and in the introductory statement to the Engineering and Architecture Group, GS-800. That material should be read carefully for a full understanding of the relationship of the engineering technician occupation to professional engineering work.

The fact that a professional engineer holds a position does not make the position a professional one. Positions should be placed in a professional engineering series only when the position requires professional competence. If an engineer is required to apply only those knowledges and abilities that are applied by technicians, the position should, of course, be classified as a technician position.

2. *Surveying Technician Series, GS-817*

Surveying is an activity common to many professional occupations such as forestry, geodesy, engineering, cartography, and geology. Positions concerned primarily with surveying work with incidental data analysis and presentation are classified in the Surveying Technician Series. Positions with responsibility for surveying, in combination with engineering technician functions such as design, are classified to the Engineering Technician Series.

3. *Engineering Drafting Series, GS-818*

This is a technical support occupation for both engineering and architecture. Engineering drafting positions involve use of graphic portrayal techniques, methods, and procedures in documenting and communicating engineering and architectural ideas and information. The primary emphasis in drafting is on conveying information as to design intent rather than on devising this information. Nonprofessional positions which require drafting skill but in which engineering design work is a primary or paramount consideration belong in the Engineering Technician Series. In many organizations there is a clear career ladder from draftsman to engineering technician positions.

Positions concerned with the review of drawings are classified in the Engineering Drafting Series when the emphasis in the appraisal of the drawings is on the completeness, correctness, and adequacy of the drafting work, i.e., whether the drawings are neat and logically arranged; contain appropriate dimensioning and notes; and provide clarifying details, views, and sections. Nonprofessional positions in which the emphasis is on the review of drawings for production feasibility, performance, safety, durability, and other elements of design judgment are to be classified in the Engineering Technician Series. In the latter case it is the design intent contained in the drawings which is appraised rather than the drawings per se.

4. *Construction Control Series, GS-809*

This series includes positions which involve maintaining surveillance and on-site inspection of contracts for the construction, remodeling, or repair of structures and facilities.

5. *Construction Analyst Series, GS-328*

Positions in this series involve application of knowledge of architectural design and construction practices for housing including the examination of drawings and specifications, estimation of costs, and development of cost information.

6. *Electronics Technician Series, GS-366*

This is the technician counterpart occupation for the Electronic Engineering Series, GS-855. Positions which involve engineering work on electronics systems and equipment but for which recruitment need not be based primarily on knowledge of principles, methods, techniques of electronics are classified in the Engineering Technician Series.

7. *Industrial Engineering Technician Series, GS-895*

This is the technician counterpart occupation for the Industrial Engineering series, GS-896, and is typically found in an industrial setting. The work involves such studies as engineered time standards, methods engineering, materials handling or manpower utilization.

8. *Engineering and Architecture Student Trainee Series, GS-899*

This series includes positions in programs consisting of (a) preprofessional on-the-job training in engineering or architecture at a Federal establishment, and (b) pertinent education leading to a bachelor's degree at a college or university. Positions of engineering students who receive temporary employment which is not a part of a planned preprofessional training program to prepare them for future professional work are classified in the Engineering Technician Series, GS-802.

9. *Physical Science Technician Series, GS-1311*

Physical science technicians apply a practical knowledge of the methods and techniques of one or more areas of physical science. The distinguishing characteristic of the physical science technician position is the required technical knowledge of certain physical science fields, e.g., chemistry, oceanography, hydrology, physics. When this practical knowledge of a physical science is the paramount requirement-as opposed to technical engineering knowledge-the position is properly classified in the Physical Science Technician Series, even though the work is performed in support of engineers. If the physical science technician and the engineering technician duties of a position are of equal classification value, then the type of occupation supported may be significant in determining the appropriate series.

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10. *Cartographic Technician Series, GS-1371*

This series includes technical work involved in the construction, compilation, drafting, and editing of maps and charts and related activities requiring primarily technical knowledge of cartography.

11. *Equipment Specialist Series, GS-1670*

This series includes positions which involve developing and providing technical information about equipment and developing equipment maintenance programs and techniques. Such work is based primarily on a practical knowledge of the characteristics, properties, and uses of equipment.

Many equipment specialist positions include responsibility for participating in the accomplishment of such engineering functions as design analysis or test of equipment. If the paramount requirement of the position is the ability to recommend practical design modifications which are based primarily on a knowledge of the uses, properties and characteristics of equipment and which are intended to eliminate or ease field maintenance, operating or logistical problems, then it is an equipment specialist position. If the primary requirement of the position is the ability to modify the dimensions, shapes or clearances specified in designs through the application of practical knowledge of engineering methods and techniques, then the position is that of an engineering technician.

12. *Other related General Schedule occupations*

Among the other series which include some positions similar to engineering technician positions are the Safety Inspection Series, GS-1820; Industrial Specialist Series, GS-1150; Mathematics Technician Series, GS-1521; Buildings and Grounds Technical Management Series, GS-1641; various series in the Commodity Quality Control, Inspection, and Grading Group, GS-1900; and Preservation and Packing Series, GS-2032. Standards for these occupations define coverage and make distinctions from the Engineering Technician Series.

DISTINGUISHING BETWEEN ENGINEERING TECHNICIAN AND TRADES POSITIONS

Engineering technician positions and trades positions excluded from the General Schedule sometimes involve overlapping activities. Some nonprofessional technical work in engineering requires manual and craft skill in varying degrees. Work at an advanced level of competence in a skilled trade, especially when in support of research and development, often involves some duties and requires knowledges that are similar to those of engineering technicians.

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In some cases the contribution to design and development or other technical aspects of the work of a position requiring competence in a trade may be significant in evaluating the level of difficulty, responsibility, and qualifications required for the work. It does not necessarily follow that such positions are under the General Schedule.

Section 5102(c) (7) of Title 5 of the U.S. Code exempts from the General Schedule: *"employees in recognized trades or crafts, or other skilled mechanical crafts, or in unskilled, semiskilled, or skilled manual-labor occupations."* (Italics added.)

The chapter on "Determining Coverage by the General Schedule or the Federal Wage System" (Section IV of the Introduction to the Position Classification Standards) contains general criteria for determining the exemption from or inclusion under the General Schedule. The following material supplements the criteria in those guidelines for positions of fabrication mechanics. For certain positions of fabrication mechanics, the above quoted criterion for exemption is controlling, that is, the position is in a recognized trade or craft, as indicated below.

Fabrication mechanics

Positions of modelmakers, instrumentmakers, glassblowers, and other mechanics who contribute to design and development in fabricating items are excluded from the Engineering Technician Series. The work may involve conceiving and fashioning a new piece of equipment or improvement of fabrication methods and techniques. The following situation is illustrative:

In a shop work situation, fabricates test models, instruments, or other devices required in research and development activities. Assignments are outlined orally with rough sketches by a scientist or engineer. Calculates loads, sizes, dimensional fits, weights, moments and other aspects using standard formulas, criteria, and handbook tables. Consults with project originator and shop supervisor when problems arise because of unsuitable materials or unrealistic fabrication requirements. Provides information on materials characteristics and methods and techniques of shaping, and machining metals which bears on design specifications. Experiments with materials and techniques to arrive at a practical solution of the fabrication objectives. Develops new or modifies existing tools, jigs, fixtures, test stands, and other equipment needed to fabricate item. Uses all standard and precision tools and equipment as required to fabricate item and directs the work of skilled mechanics performing special phases.

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Such positions are considered to be trades positions rather than engineering technician positions for the following reasons:

1. The requirement for contributing and relating practical trades knowledge of materials, manufacturing processes, and fabrication details to engineering design and development function is an inherent part in some trades, and not a normal function of an engineering technician. (See descriptions of key ranking jobs of Modelmaker WG-14 and Instrumentmaker WG-15 under Coordinated Federal Wage System.) Experienced instrumentmakers, glassblowers, welders, and other laboratory mechanics are expected to contribute to some extent to the design of the device

fabricated, to improve or modify fabrication methods for special assignments, and to experiment with use of new materials. Such contributions to design and development on devices fabricated, or on fabrication techniques, represents a higher level of competence in the trade rather than a basis for identification as an engineering technician.

2. Positions in fabrication shops which involve the kind of contributions to design and development described above differ only in degree from very similar trades positions in the same organizational unit. These similar positions in the same shop unit should be under the same pay system.
3. The career ladder of the position is in the trade. Not only is recruitment necessarily from journeyman mechanics, but the normal line of promotion in the organizational unit is to supervisory shop positions. The fact that the employee applies knowledges that qualify him for reassignment to certain engineering technician positions does not change the essentially trades nature of his position.

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Thus, the position in question is properly regarded as being *in a trade* and not as a combination of trades duties and higher level engineering technician duties.

On the other hand, many engineering technician positions involve similar contributions to design and development, and incidental fabrication work under the administrative and technical supervision of an engineer. Such an engineering technician may use trade knowledge and background and may incidentally use a variety of machine tools in fabricating items in lieu of requesting fabrication by the shop. However, he would typically not be required to apply journeyman level competence in a skilled trade as in the shop situation above. Where an engineering technician applies skills in fabrication of equipment, the fabrication and associated contribution to development and design are incidental to his broader responsibilities for research, test, evaluation, etc.

Where neither trade nor engineering functions are predominant, the decision as to the paramount requirement of the work for pay category purposes must be based on considerations such as career patterns, knowledge and ability required, job environments and management requirements and intent.

SPECIALIZATIONS

Many engineering technician positions involve a high degree of specialization in unique work situations, each with a somewhat distinct set of knowledge, skill, and ability requirements. Nevertheless, there are basic knowledges and skills that are transferable from work in one specialization to work in another. Separate identification of a large number of specialties and subspecialties is impractical and tends to complicate classification practice and encourage the development of artificial barriers to movement between specializations. Therefore, the

specializations established are those aligned generally with major academic fields for which professional series have been set up.

The following subject-matter specializations are authorized for positions in grades GS-4 and above:

Aerospace - Work concerned with aerospace vehicles, systems, phenomena, and structures.

Architecture - Work concerned with buildings or land areas requiring knowledge of practices of architecture or landscape architecture.

Biomedical - Work concerned with biomedical equipment and systems used in the care and treatment of patients or in biomedical research.

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Chemical - Work concerned with processes, plants, equipment, and methods for the production of chemical products or changes in the chemical composition or physical state of materials.

Civil - Work concerned with buildings, structures, dams, soil mechanics, tunnels, highways, water resources, bridges, airports, railways, and other phases of civil engineering.

Electrical - Work concerned with systems, plants, equipment, and materials for the generation, transmission, conversion, distribution, control, measurement, or utilization of electrical energy. Included in this specialization are positions which involve the design of electronic installations where the work does not require knowledge of electronics to the extent characteristic of the Electronics Technician Series, GS-856.

Materials - Work concerned with the properties, characteristics and use of engineering materials.

Mechanical - Work concerned with systems, plants, machines, equipment, and instruments for the generation, transmission, measurement or utilization of heat or mechanical power. Included are steam and internal combustion powerplants, automotive and ordnance equipment and components, heating and air conditioning, piping, machine tools, and instruments and controls.

Mining - Work concerned with the discovery and extraction of solid fuels, ores, and minerals.

Naval Architecture - Work concerned with the form, strength stability, performance, and operational characteristics of ships. (NOTE: Naval architecture is a recognized branch of engineering.)

Nuclear - Work concerned with design, installation, testing, and operation of nuclear reactors, nuclear powerplants, and other nuclear systems.

Petroleum - Work concerned with the discovery, development, production, and conservation of petroleum, natural gas, or helium.

TITLES

The following titles are authorized for positions in this series:

Engineering Aid: for all positions at grades GS-1, GS-2, and GS-3.

For positions at grades GS-4 and above in various subject-matter specifications, the following titles should be used:

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Aerospace Engineering Technician
Architecture Technician
Biomedical Engineering Technician
Chemical Engineering Technician
Civil Engineering Technician
Electrical Engineering Technician
Materials Engineering Technician
Mechanical Engineering Technician
Mining Engineering Technician
Naval Architecture Technician
Nuclear Engineering Technician
Petroleum Engineering Technician

Engineering Technician: This title applies to positions that cover two or more of the subject-matter specializations when no one is paramount and to positions for which none of the authorized specializations is appropriate.

Positions which require supervisory qualifications are identified by the prefix "Supervisory."

CLASSIFICATION CRITERIA

Grade levels are defined under two broad classification criteria:

Nature of Assignment and Level of Responsibility.

Qualification requirements are not described separately, but rather have been reflected as appropriate under both Nature of Assignment and Level of Responsibility.

Nature of assignment

This includes the scope and difficulty of the project and the skills and knowledges required to complete the assignment. For example, at lower grade levels, selection and application of techniques and methods are significant; at intermediate levels, minor modification, interpretation and analysis enter the picture; and, at higher levels, project complexity may be comparable to that of professional engineering assignments and may require considerable knowledge of specialized engineering practice.

Level of responsibility

This includes consideration of the nature and purpose of person-to-person work relationships, and supervision received in terms of intensity of review of work as well as guidance received during the course of the work cycle.

The personal contacts that the technician maintains with others, and the extent to which his technical judgments are relied upon without detailed review are important considerations in determining the level of responsibility.

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At lower levels, the availability of specific and detailed established procedures and the degree of supervision received are of primary significance. At higher levels, the freedom to plan and execute assignments and independently coordinate the project with other individuals and groups is more frequently to be considered.

Illustrative assignments

Illustrative examples of assignments are provided at each level. These examples are not all-inclusive, nor does any one example stand in isolation. Each must be applied in the light of the conditions and controls described under the grade-distinguishing criteria. The presence of an example for a particular specialty at a given grade level should not be interpreted as defining the grade level or as setting a floor or ceiling on engineering technician work in that field or function. The absence of an example at a particular grade level obviously does not preclude classification of jobs in a particular specialty at that level.

NOTES ON GRADE-LEVEL CRITERIA

This series is a one-grade interval series.

The grade-level criteria in this standard cover nonsupervisory positions in grades GS-1 through GS-11. Because positions at grade GS-10 were found to be highly individualized, it was not practical to develop criteria for positions at this level. Accordingly, such positions should be evaluated by comparison with the criteria for GS-9 and GS-11.

The grade-level criteria in this standard at grades GS-9 and GS-11 are designed to provide consistency in the classification of positions of technicians and engineers who perform similar work. The criteria and illustrations in the standard at grade GS-11 are similar to those in the standards for professional engineering positions at the same grade. As appropriate, illustrations in the GS-11 professional standards may be used to supplement those in this standard at GS-11. Section VII of the Introduction to the Engineering and Architecture Group, GS-800, contains valuable guidance on the use of professional engineering standards in the evaluation of technician positions.

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Engineering technician positions that clearly exceed the GS-11 grade level may be evaluated by extension of the criteria in this standard in combination with comparison with grade-level criteria in appropriate standards for engineering positions. Positions should not be classified on the basis of merely matching duties with those in the illustrative assignments. Judgment must be applied in determining the degree to which the specific position being classified fits the intent of the standards.

Supervisory positions

Supervisory positions are included in this series. This standard does not provide grade-level criteria for classifying positions in which supervisory responsibilities are grade controlling; supervisory positions should be evaluated by reference to the General Schedule Supervisory Guide.

Use of standards for other technician occupations

Many positions in this occupation also include duties covered in standards for related occupations such as Construction Control Series, GS-809; Surveying Technician Series, GS-817; Electronics Technician Series, GS-856; Physical Science Technician Series, GS-1311; Engineering Drafting Series, GS-818; Industrial Engineering Technician Series, GS-896; Cartographic Technician Series, GS-1371; and the Equipment Specialist Series, GS-1670. In such instances, the standards for the related technician occupations should be used in combination with these standards.

ENGINEERING AID GS-0802-01

Nature of assignment

GS-1 engineering aids learn the basic methods, techniques, and procedures for one or a few simple tasks. They learn to make routine measurements, simple arithmetic computations and instrument readings and to record specified data. In addition, GS-1 aids help higher grade aids or technicians by performing the simplest manual tasks. GS-1 aids are not required to apply experience or familiarity directly related to specific technical tasks.

Level of responsibility

As trainees, GS-1 aids receive very close supervision. Detailed instructions are furnished. Procedures, methods, and techniques are demonstrated. The aid's work is continuously observed, spotchecked, checked upon completion, etc., as appropriate.

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ENGINEERING AID GS-0802-02*Nature of assignment*

Engineering Aids GS-2 perform a limited variety of simple, repetitive tasks requiring a knowledge of simple work procedures performed in a fixed or prescribed sequence. GS-2 aids receive training to acquire specific subject-matter knowledge or skills of the type applied by GS-3 engineering aids. The following tasks are illustrative:

1. Measures items of regular shape with a caliper and computes cross sectional areas.
2. Identifies, weighs, and marks a limited variety of easy-to-identify items and records the information.
3. Assists in the assembly, installation, or operation of equipment, instruments, or facilities by performing specified manual tasks.
4. Records instrument readings at specified intervals.

Level of responsibility

GS-2 aids receive supervision which is initially as close as is typical of the GS-1 level, but which lessens as tasks recur. New methods, procedures, and techniques are demonstrated once or several times, as necessary, and/or are written out in detail. Guidelines are specific, detailed, and fully applicable. Unlike GS-1 aids, GS-2 aids performing repetitive assignments are expected to select and apply the appropriate guidelines and procedures from those they have used. Assistance is readily available when problems arise. As routine tasks recur, supervision diminishes to the point where work is spot-checked in progress and upon completion.

ENGINEERING AID GS-0802-03*Nature of assignment*

Positions at this level differ from those at GS-2 in that the work at GS-3 is characterized by (a) required knowledge of detailed procedures which are either established and repetitive or which are specified by the supervisor at the time of initial performance, and (b) some readily-acquired skill or subject-matter knowledge.

The following tasks are illustrative:

1. Examines visually materials, instruments, equipment, or items to be tested for flaws or defects.
2. Observe operation on instruments and equipment to detect apparent malfunction.
3. Observes obvious deviations in data and checks to ascertain apparent cause.
4. Operates simple test instruments and controls during tests, makes simple adjustments, and records data.
5. Performs specified arithmetic computations, using standard tables and substituting in formulas.
6. Plots data or results and draws simple curves.
7. Assembles, installs, and maintains instruments and equipment involving simple wiring, soldering, grinding, etc.
8. Abstracts and compiles specified data from records or other sources such as specifications and drawings.

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Level of responsibility

GS-3 aids receive complete, explicit oral and/or written instructions at the beginning of each assignment, covering work methods, available equipment, procedures, reference guidelines, etc. These instructions are more complex and voluminous than is typical for positions at grade GS-2. The supervisor is available for instruction and guidance at any time. GS-3 aids are expected to perform recurring tasks under supervision which gradually lessens until the more routine, recurring tasks are only infrequently spot-checked or observed. The less routine tasks are occasionally checked in progress or upon completion. At grade GS-2 the supervision received is more intensive.

ENGINEERING TECHNICIAN GS-0802-04

Nature of assignment

The work differs from that at GS-3 in that technicians at GSA carry out a more varied and complex sequence of standardized or prescribed operations. GS-4 technicians apply a limited background of knowledge of engineering methods and practices in the specialization or area of assignment.

A. Testing

Engineering Technicians GS-4 perform a variety of tests in accordance with established methods. The work typically involves such related tasks as preparing test specimens, adjusting and operating equipment, and recording instrumental readings.

The test equipment is of proven reliability (i.e., it is widely used in testing work, its limitations and capabilities are well known, and few problems are involved in operation) and the test procedures have been standardized. The test procedures require skill in the adjustment and operation of the equipment in order to obtain data to avoid possible damage or personal injury. Less skill is required at GS-3 in that sound, reproducible data are readily obtainable; deviations in test data and atypical samples are referred to others.

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The Testing work requires judgment, knowledge, and skill in:

- (1) Examining the test specimens for faults or defects which may affect the data;
- (2) Determining whether the test data fall within normal limits;
- (3) Determining the apparent causes of deviations in the test data resulting, for example, from equipment malfunctions, observational errors, and other causes.

Illustrative assignments

1. Performs a variety of standardized, repetitive tests on soils, concrete, and concrete aggregates. The simpler tests of the type performed at GS-3 include sieve analyses, slump tests, and density and moisture content determinations. The GS-4 technician also performs tests to determine the liquid and plastic limits of soils or the flexural and compressive strength, air content, and modulus of elasticity of concrete.
2. Performs a variety of standardized tests on electrical cables to determine their electrical and mechanical properties. The tests include determinations of weight, diameter, insulation breakdown resistance, conductivity, twisting and bending qualities, and abrasion resistance. The testing involves the use of electrical bridge circuits, high voltage sources, and special machines for measuring the mechanical properties of the cables.
3. Tests and calibrates a variety of single purpose research instruments such as pressure indicators, thermocouples, multiple recording instruments, tachometers, and potentiometers. In accordance with specific instructions as to range of calibration, connects these instruments to standard instruments and follows established test procedures. Records readings of instruments and plots calibration curves for correction factors.

B. *Data analysis and presentation*

Engineering Technicians GS-4 analyze and present data in accordance with established methods. The work is characterized by the required application of judgment and knowledge in tasks such as the following:

- (1) Extracting data from a variety of prescribed but non-standardized sources (at GS-3 sources are typically standardized);
- (2) Recognizing errors which are readily apparent (e.g., misplaced decimal points and reversal of algebraic sign), but which require a limited knowledge of the subject matter;
- (3) Processing the data according to well-defined methods and designated formulas using elementary algebra and geometry, in addition to arithmetic.

Illustrative assignments

1. Computes the volumes and surface areas for enclosures of primarily regular shape using the data contained in sectional drawings and perspective drawings, supplemented by actual measurements. The work also includes the use of instruments for measuring the cross-sectional areas and linear distances, and the operation of a desk calculator. Algebraic formulas are used to compute volumes and surface areas.
2. Computes from test firing data on small ammunition, the center of impact, frequency distribution, standard deviation and probable error, and presents the information by various graphical means. Uses designated criteria to compare the data with results obtained from other firings to ascertain whether there are significant differences in the distribution patterns.
3. Compiles and computes hydrologic and sedimentation data necessary for the design by others of small water control structures. From field notes and construction drawings provided, compiles and computes earthwork quantities, plots profiles, cross sections, and topography.

Level of responsibility

The level of responsibility at GS-4 is characterized by the following:

- a. Routine assignments which involve conditions, concepts, and methods familiar to the technician are made in terms of the objectives to be achieved and without explicit instructions as to work methods, if standard work methods can be used; GS-3 engineering aids typically receive instructions on work methods in such cases.

- b. Recurring routine technical problems are resolved on the basis of previous experience without reference to the supervisor. GS-3 aids refer technical problems to the supervisor.
- c. Explicit instructions for solving technical problems involving unfamiliar conditions, methods, or concepts are provided by the supervisor.
- d. The technical adequacy of completed routine work are reviewed or checked for adherence to instructions; nonroutine assignments are reviewed in process.

ENGINEERING TECHNICIAN GS-0802-05

Nature of assignment

Engineering Technicians GS-5 carry out operations in variable sequences that are not completely standardized or prescribed as at grade GS-4. The GS-5 technician uses a variety of standard references, guides, and precedents to obtain needed information and to select and adapt methods and procedures. GS-5 technicians apply a background of knowledge and understanding of engineering practice based on a background of substantial training and experience in the specialty field. At grade GS-4 the work involves primarily application of established practices; GS-5 employees are typically required to select and adapt methods and procedures

A. Testing

Engineering Technicians GS-5 perform tests for which procedures have been developed but not completely standardized and that require modifications in test procedures and test equipment. GS-5 technicians also perform such related tasks as preparing test specimens, adjusting and operating equipment, recording instrumental readings, and evaluating test data. The test equipment and test procedures require some experimental skill and judgment in order to obtain accurate, reproducible data.

GS-5 positions differ from similar positions at grade GS-4 in that the GS-5 employee applies specialized knowledge, skill, and judgment to a significant degree in tasks such as the following:

- (1) Adapting and devising simple auxiliary devices such as supports, adaptors, couplings, and holders;
- (2) Adjusting equipment to insure optimum operation;
- (3) Determining results of tests that are not susceptible to precise, quantitative measure but require subjective de-terminations;

- (4) Determining the causes of deviations in the test data, e.g., equipment malfunctions or observational errors.

Illustrative assignments

1. Performs tests to determine the flame resistance of insulating materials. The test procedures include such operations as: adjusting the gas flame (i.e., gas mixture and gas pressure); attaching thermocouples to the test specimen; connecting the thermocouple leads to recording devices; mounting the test specimen to insure proper exposure to the gas flame; observing and recording the behavior of the test specimen; and determining the degree of flame resistance in relation to other materials.

In these test procedures judgment and experience are required in adjusting the gas flame, positioning the specimen in relation to the flame, and evaluating the behavior of the test specimen. Some of these determinations are subjective in nature since they do not lend themselves to objective measurement.

2. Performs tests on equipment and components to determine whether they present explosion hazards. The test procedures include such operations as: mounting the test item in the explosion chamber; adapting connectors and couplings to permit remote operation; adjusting conditions within the chamber to simulate various altitudes and different air and vapor mixtures; operating the controls on the test item to simulate operating conditions; and isolating the source of the explosion (e.g., sparking of electrical contacts and high voltage corona discharges).

In these tests there are no precise quantitative measurements and judgment and experience are required in examining the equipment or components to determine the point at which the explosion was initiated and the cause (e.g., faulty sealing of switchbox and inadequate spark suppression).

3. Tests and calibrates a variety of research instruments, such as displacement gages, recorders, altimeters, and tachometers. Determines range of instruments to be calibrated, selects and sets up test equipment and adapts standard calibration procedures based on experience with similar instruments. The work differs from GS-4 in that greater judgment and experience are required in overcoming difficulties such as fluctuating indicators, instability, and poor response.

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B. *Data analysis and presentation*

The work differs from similar work at grade GS-4 in that the GS-5 technician applies judgment and knowledge in selecting sources, evaluating data and adapting methods in tasks such as the following:

- (1) Extracting data from a variety of sources (e.g., field notes, design manuals, laboratory reports, handbooks, etc.) requiring knowledge of the applicability and use of the data and the characteristics of the sources (at grade GS-4, sources are normally prescribed);
- (2) Recognizing and reporting errors, inconsistencies, and other deficiencies in the technical data. This requires a knowledge of the methods by which the data were derived, and the possible sources of error;
- (3) Selecting the method for presenting the data for internal use, using tabular and graphical means (e.g., logarithmic, rectilinear and polar coordinates) where the work requires use of statistical and graphical methods of curve fitting and curve smoothing.

Illustrative assignments

1. Computes and tabulates quantities for road projects including structures such as box culverts and retaining walls. Checks preliminary and final estimates of quantities prepared by others. Plots roadway alignments, grade lines, cross sections, culvert locations, and related information from field notes and other sources. Computes vertical and horizontal curves and rough earthwork balance, using earthwork charts and diagrams.
2. Using established procedures and engineering notes and survey sheets, makes computations for the outline of construction site of small earth dam. Plots profiles, cross sections and drainage areas. Outlines drainage and locates site on map. Determines maximum estimated runoff for floods. Computes the flood storage and sediment storage expected for a given number of years. Computes earth quantities for embankment stripping and excavating of the dam. Computes hydraulics of flow through outlet structure and spillway.

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B. *Data analysis and presentation*

The work differs from similar work at grade GS-4 in that the GS-5 technician applies judgment and knowledge in selecting sources, evaluating data and adapting methods in tasks such as the following:

- (1) Extracting data from a variety of sources (e.g., field notes, design manuals, laboratory reports, handbooks, etc.) requiring knowledge of the applicability and use of the data and the characteristics of the sources (at grade GS-4, sources are normally prescribed);
- (2) Recognizing and reporting errors, inconsistencies, and other deficiencies in the technical data. This requires a knowledge of the methods by which the data were derived, and the possible sources of error;

- (3) Selecting the method for presenting the data for internal use, using tabular and graphical means (e.g., logarithmic, rectilinear and polar coordinates) where the work requires use of statistical and graphical methods of curve fitting and curve smoothing.

Illustrative assignments

1. Computes and tabulates quantities for road projects including structures such as box culverts and retaining walls. Checks preliminary and final estimates of quantities prepared by others. Plots roadway alignments, grade lines, cross sections, culvert locations, and related information from field notes and other sources. Computes vertical and horizontal curves and rough earthwork balance, using earthwork charts and diagrams.
2. Using established procedures and engineering notes and survey sheets, makes computations for the outline of construction site of small earth dam. Plots profiles, cross sections and drainage areas. Outlines drainage and locates site on map. Determines maximum estimated runoff for floods. Computes the flood storage and sediment storage expected for a given number of years. Computes earth quantities for embankment stripping and excavating of the dam. Computes hydraulics of flow through outlet structure and spillway.
3. Assists design modification project leader by compiling related design, specifications, and materials data pertinent to specific items of equipment or component parts. Develops information concerning overhaul history, operational failures, unsatisfactory reports, previous modifications, and experience of other organizations with item. Compiles data in summary form. Exercises judgment and initiative in recognizing inconsistencies or gaps in the information and in seeking possible sources of data.

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Level of responsibility

The level of responsibility at grade GS-5 is characterized by the following:

- a. Work assignments, which involve concepts and nonstandard methods familiar to the technician, are made in terms of the objectives to be achieved and without explicit instructions as to work methods. At grade GS-4 instructions normally cover nonstandard work methods.
- b. Nonroutine technical problems of the type previously encountered by the technician in the course of the work are typically resolved independently, but may be referred to others in unusual cases.
- c. Assistance in solving technical problems involving unfamiliar methods or concepts is provided by the supervisor. At grade GS-4 specific instructions are usually provided in such cases.

- d. The methods applied and technical adequacy of the completed work are reviewed or checked. Narrative assignments are typically not revised in process as at grade GS-4.

ENGINEERING TECHNICIAN GS-0802-06

Nature of assignment

Engineering Technicians GS-6 carry out nonroutine assignments of substantial variety and complexity. The work is more complex than that typical of grade GS-5 in that GS-6 employees apply a background of knowledge based on intensive training and diversified experience in the particular specialty field and, in addition, knowledge of engineering practice in related fields.

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A. Testing

Engineering Technicians GS-6 perform tests for which procedures have been developed but not completely standardized, requiring the selection and modification of test equipment and test procedures in accordance with test plans and programs developed by others. The GS-6 technician performs testing work which is more complex than that performed by GS-5 technicians in that the work at grade GS-6 requires greater skill to obtain reproducible data or greater judgment to interpret and evaluate test conditions and results.

Illustrative assignments

1. Performs shock and vibration tests in accordance with test plans and test equipment specified by the supervisor. Mounts the test items and sets up sensors and recording devices. Modifies test procedures and equipment as required. Observes tests recorded data for spurious or unusual responses indicating failure or malfunction in the test equipment. Visually examines the test item to determine apparent damage or change and reports findings.
2. Performs a wide range of standard and special purpose tests of soils, concrete, and other materials used in construction of dams, tunnels, powerplants, etc. Calibrates laboratory equipment and modifies test equipment or procedures to meet unusual field conditions or special requirements. Inspects contractor's concrete manufacturing operation for compliance with specifications and recommends, through supervisor, correction of concrete mix.

B. Data analysis and presentation

Engineering Technicians GS-6 apply and adapt a wide variety of established methods of computation and analysis under a variety of circumstances. The work is more demanding

than at grade GS-5 in terms of breadth of required knowledge and judgment required to evaluate and interpret data.

Illustrative assignment

1. Compiles, computes, plots, and checks a variety of data for construction projects such as a large, earth-filled dam with associated pumping plants, highway relocations, canals, etc. Data are used for compilation and checking of contract summaries, preparation of abstracts of bids, estimates of cost for payment of contractors, and field support. Reduces and plots field survey notes and tabulates data from inspection reports and other field reports in computing volumes of excavation and embankment earthwork, volumes of concrete, weights of materials, and work accomplished. Makes sketches, drawings, diagrams and charts for excavation, embankment, structures, triangulation, profiles and traverses, etc., to assist field forces in staking out work and to facilitate computation or quantities. Contacts field inspectors, surveyors, contractor's representatives, and others to check on and to exchange information pertinent to project construction.

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Level of responsibility

The level of responsibility is characterized by the following:

- a. Work assignments which involve concepts and nonstandard methods familiar to the technician are made in terms of the objectives to be achieved and without explicit instructions as to work methods.
- b. Technical problems, including some not previously encountered by the technician, and involving concepts and methods for which agency guides and precedents are applicable, are resolved independently. At grade GS-5 technical problems solved independently are typically of the type previously encountered.
- c. Supervisor provides assistance in solving unfamiliar technical problems involving methods or concepts not covered in agency guides or precedents.
- d. Completed work is reviewed for technical adequacy. The methods applied by the technician are not normally reviewed as at grade GS-5.

ENGINEERING TECHNICIAN GS-0802-07

Nature of assignment

Engineering Technicians GS-7 apply initiative and resourcefulness in planning nonroutine assignments of substantial variety and complexity. GS-7 technicians select appropriate

guidelines to resolve operational problems not fully covered by precedents. At grade GS-6 precedents have more specific applicability. Engineering Technicians GS-7 are required to develop revisions to standard work methods and procedures; modify parts, instruments, equipment; and take actions or make recommendations based on preliminary interpretation of data or results of analysis.

A. Testing

Engineering Technicians GS-7 perform tests requiring the selection and substantial modification of equipment and procedures, in accordance with test programs developed by others. The test equipment and test procedures require considerable experimental skill and judgment to obtain reproducible data and to recognize and interpret reactions that are difficult to observe (e.g., of a transient nature) and that can significantly affect the validity of the data.

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Illustrative assignments

1. Performs shock and vibration tests on equipment in accordance with test programs developed by the engineer in charge. The test procedure includes such operations as: mounting the test item; selecting and designing necessary simple brackets, fixtures, and mountings; selecting suitable sensors (e.g., strain gauges, accelerometers, and velocity pickups) and recording devices (e.g., high-speed cameras, oscillographs, and multi-channel tape recorders); connecting the test equipment; examining the recorded data for spurious responses indicating failure or malfunction in the test equipment; examining the test item to determine the nature and extent of the damage; and submitting a report of the findings. Problems arise from the variety of the test equipment which is used and the critical nature of many of these devices. The short duration of the tests (e.g., shock tests) and high accelerations and forces involved, present measurement and recording problems which are resolved by employees at higher levels.
2. Performs tests on electrical insulating materials to determine the effect of, heat, high voltage, and other ambient conditions. Determines the conditioning cycle to which the test specimens will be subjected (e.g., temperature range and length of time at each temperature). Also involved is the modification of test equipment (e. g., design of electrical controls to permit automatic cycling at present rates). Judgment is required in modifying test equipment and test procedures, and in recognizing significant changes in the properties of the insulating materials.

B. Design and specification

Engineering Technicians GS-7 apply conventional, well-established engineering practice in a subject-matter area of limited scope. Guides and precedents are applicable to the assignments which are characteristically similar to those previously worked on in the organization, are typically parts of broader assignments, and are screened to eliminate complex or unusual

design problems. Assignments differ from precedents in relatively minor respects such as arrangement, loading, capacity, length of span, or gear ratio.

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Judgment, initiative, resourcefulness, and knowledge based on experience are required in:

- (1) The analysis and extraction of pertinent data from a variety of sources including journals, engineering hand-books, manufacturers' catalogs, agency publications, precedent designs, standard and guide specifications, and other references;
- (2) The selection of alternatives and development of designs and/or specifications which will satisfy specific criteria and requirements;
- (3) Devising of means to overcome problems such as space and weight limitations and interferences; and
- (4) Analysis of adequacy of designs and specifications for conformance to specific requirements.

Positions at grade GS-6 concerned with design and specifications typically involve a lesser degree of responsibility for design, and are concerned primarily with the collection, documentation, and communication of design information rather than the performance of design. Accordingly, such positions are likely to be properly classified in the Engineering Drafting Series, GS-818.

Illustrative assignments

1. Writes or reviews assigned sections of project specifications pertaining to a variety of materials and construction methods such as roofing, flooring, foundation damp-proofing and waterproofing, caulking, and glazing. Selects and adapts stock paragraphs from guide specifications and previously approved project specifications. Writes items describing materials or methods by analyzing and extracting information from drawings, notes, and other sources. Applies judgment in determining adequacy of items to satisfy design requirements.
2. Reviews designated portions of plans submitted by contractors for interior electrical wiring of residential or office buildings for light and power. On the basis of a practical knowledge of methods and techniques of electrical engineering design, reviews drawings, basis for design, and design analysis for conformance to established engineering standards and criteria set forth in manuals, codes and other guides, and the specific project requirements. Checks accuracy of calculations of loads, illumination, conductor sizes, etc., and adequacy of switches, controls, and other equipment selected by contractor. Calls attention of supervisor to major deficiencies and items not covered by guides. Reviews revised plans to assure correction of deficiencies.

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3. From information in the form of sketches, development models, and guidance as to design criteria, prepares layouts, detail, assembly, and installation drawings of equipment of noncritical nature such as containers, hardware fittings, test stands and equipment, etc., involving a variety of mechanisms, gears, materials, and conditions of use and production. On the basis of knowledge of similar items and information furnished, performs calculations, and prepares detailed design. Exercises judgment in making engineering determinations such as type of metal or materials from which parts should be made; whether they should be cast or welded construction; most efficient way to design the parts; appropriate hole sizes and locations; how parts should be arranged to be efficiently installed; what finishes are to be used; most practical method of constructing equipment; size of various members to give required strength; clearances required; and simplicity of design to reduce manufacturing cost. Receives detailed guidance on novel or critical aspects of designs.
4. Prepares working plans for shipboard installation of the portions of piping systems of conventional types. Using compartment plans and agency guides and precedents, applies a knowledge of ship structure and operating requirements and of ship construction practice to determine sizes, location, materials, and design details of equipment and system components. Visits vessels and contacts other designers to obtain information concerning available space and arrangements. Nonroutine problems of interference and system coordination are typically referred to others.

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5. Working from specified design criteria, soils and survey data of area involved, and plans of existing facilities and sketches of proposed small buildings, prepares a site layout design of proposed project taking into consideration such data as topography, location of existing structures and availability of utilities. Prepares sketch plans for rough and finish grading of sites on which facilities are to be provided. Prepares plans for grading sites to allow for surface drainage and to provide adequate access and proper functional operation of the facilities. Gives special attention to elimination of excessive cuts and fills and any other factors which would tend to increase construction costs. Prepares alternate-site locations and grading plans where possible and makes preliminary cost estimates working from furnished unit prices, for use by others in determining economic feasibility.

C. Research and development

Engineering Technicians GS-7 apply methods outlined by others to limited segments of research and development projects. This includes the refinement or modification of standard equipment or techniques, and the performance of a variety of functions such as assembling and installing equipment and instruments, conducting experiments, recording and evaluating data, and reporting findings.

Judgement, initiative, resourcefulness, skill, and knowledge based on experience are required in:

- (1) Assembling and installing complex precision instruments and devices;
- (2) Modifying or adapting instruments and equipment to obtain desired performance characteristics;
- (3) Devising experimental techniques; and
- (4) Observing significant trends in experimental data.

Illustrative assignments

1. Participates in the development of new types of scientific instruments and devices. Makes mockups of new scientific instruments. Tests and calibrates completed instruments. In construction of instruments, does specialized experimental development as distinguished from the fabrication and machining operations performed in shops. Under guidance of others, investigates and develops construction techniques involving trial-and-error experimentation with various types of materials suggested by specialists concerned with properties of materials.
2. Modifies, constructs, tests, and operates a variety of equipment and instruments used in field experimentation. In preparation for extensive field tests, modifies cameras, recorders, and other instruments to adapt to field conditions and the specific experiments to be performed. For example, working from a circuit diagram provided, design's layout for the recorder, converter, storage batteries, wiring and housing with appropriate brackets and fittings. After construction of first unit, tests and calibrates and arranges for fabrication of additional units including procurement of parts. Participates in field experiments by installing, adjusting, operating, and maintaining equipment and instruments.

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Level of responsibility

GS-7 technicians perform assignments which require initiative and resourcefulness in planning and/or execution. GS-7 technicians independently select, interpret, and apply engineering technical guidelines in situations where precedents are not fully applicable. By comparison, GS-6 technicians independently select, interpret, and apply guidelines where precedents are applicable.

When new or significantly changed assignments are made, GS-7 technicians receive instructions and information or reference material which includes information on unfamiliar practices and problems; and closer than normal guidance is provided. When the work assigned is similar to that previously accomplished by the technician, he is relied upon to select the appropriate guidelines and complete the assignment without explicit instructions as to work methods.

GS-7 technicians may demonstrate or explain their work to others and have frequent contacts with professionals, technicians, mechanics, and others within their organization in connection with specific assignments. They represent their organization at meetings and conferences to provide factual information.

As at grade GS-6 new and significantly changed work aspects are intensively reviewed for technical adequacy. Recurring aspects of work are occasionally observed and subject to only occasional spot checks for technical adequacy. Assignments falling between these extremes are subject to normal review.

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ENGINEERING TECHNICIAN GS-0802-08

Nature of assignment

Engineering Technicians GS-8 independently plan and conduct a block of work which is a complete project of relatively conventional and limited scope or a portion of a large project with diverse components. Assignments require analyses of several possible courses of action, techniques, general layouts, or designs, and selection of the most appropriate. They generally require consideration of numerous precedents and some adaptation of previous plans and techniques. However, assignments require to only a limited degree the coordination and integration of diverse phases carried out by others. The more complex and critical aspects of problem exploration, evaluation of approaches, and development of new solutions are referred to others.

Assignments at grade GS-8 are typically broader and more complex than at grade GS-7 in that at GS-7 the assignment is typically a phase of a broader project.

Illustrative assignments

1. Conducts tests of equipment, components, and parts under a variety of simulated environmental conditions (temperature, humidity, shock, vibration, sand, etc.). Sets up tests which include devising procedures to meet special, one-time requirements of experimental models. Adapts and modifies varied test instruments and accessories used in testing of mechanical functioning of items. Investigates unusual occurrences; determines if cause is the result of a test fault or the material being tested. Recommends changes to test procedures to eliminate test faults. Recommends solutions to problems of component failure and marginal operating characteristics.
2. Prepares plans, specifications, and cost estimates for modification of interior electrical systems of small conventional buildings and structures to adapt to major alterations or changes in use. Selects and applies appropriate criteria, standards, and formulas and determines loads, sizes, controls, materials, locations, design details, clearances, etc.

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Level of responsibility

The degree of supervision received by GS-8 engineering technicians is similar to that at grade GS-7 in, that the technician receives guidance and instructions in dealing with unfamiliar practices and problems. On familiar types of assignments the GS-8 technician is relied upon to select and adapt appropriate guidelines and complete assignments without explicit instructions as to work methods and precedents. Problems not covered by guides may be solved independently but are typically referred to higher grade employees for prior review. Significant deviations from guides require approval.

The level of responsibility at GS-8 differs from that at GS-7 primarily in terms of the broader, more complex assignments which include significant responsibility for selecting from among a greater variety of alternatives based on analyses made by the technician.

ENGINEERING TECHNICIAN GS-0802-09*Nature of assignment*

Engineering Technicians GS-9 typically perform a variety of work relating to the area of specialization that requires the application of a considerable number of different basic but established methods, procedures, and techniques. Assignments usually involve independent responsibility for planning and conduct of a block of work which is a complete conventional project of relatively limited scope, or a portion of a larger and more diverse project. Assignments require study, analysis, and consideration of several possible courses of action, techniques, general layouts, or designs, and selection of the most appropriate. They generally require consideration of numerous precedents and some adaptation of previous plans or techniques. Often changes or deviations must be made during progress of an assignment to incorporate additional factors requested after commencement of the project or to adjust to findings and conclusions which could not be predicted accurately in the original plans.

Assignments of Engineering Technicians GS-9 typically require coordination of several parts, each requiring independent analysis and solution. When phases or details are performed by other groups or personnel outside the organizational unit, the technician reviews, analyzes, and integrates their work. In addition, assignments at this level require a good understanding of the effect that recommendations made or other results of the assignment may have on an item, system, or process and its end-use application.

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Assignments performed by GS-9 engineering technicians are more complex than those typical of grade GS-8. The assignments also differ from those typical of grade GS-8 by the lesser need at GS-8 to coordinate separate activities and to deal extensively with representatives of other organizations in resolving issues.

Illustrative assignments

1. Modifies established testing programs to determine the characteristics, capabilities, and limitations of aircraft or other vehicular electrical systems and to evaluate their performance. Systems and equipment are of conventional nature and applicable testing and evaluation guides and precedents are available. Analyzes the drawings, specifications and other data to determine the measurements which will be required at different points in the electrical system. Establishes a testing program to obtain the data under varying loads and operating conditions. Modifies and adapts test equipment and procedures. Analyzes the data for evidence of improper function (e.g., excessive voltage drop, poor voltage regulation, and excessive temperature rise). Determines the cause of the malfunction (e.g., faulty operation of the voltage regulator). Analyzes and evaluates the significance of test data. Writes an evaluation report of findings and recommendations.
2. Investigates reasons for the failure of engine components in service. Examines parts which have failed. Analyzes data from a variety of sources, e.g., manufacturer's drawings, specifications, and maintenance records. Determines information needed concerning characteristics, capabilities, and limitations of the test items. Selects and devises laboratory tests to simulate operating conditions. Arranges for laboratory analyses, e.g., metallurgical and chemical. Reviews laboratory reports for clues as to cause of failure, e.g., improper heat treatment of the metal or breakdown of the lubricant. Prepares report of findings and recommendations, e.g., a change in design or specifications.
3. Develops items of equipment of moderate novelty and complexity (i.e., without critical performance requirements which are difficult to satisfy) such as engine parts, research instruments, test devices, or prototype ordnance components. Professional engineers and scientists furnish information concerning purpose of equipment, basic requirements of form, size, weight, structure, and performance, and pertinent technical data, and suggest possible design approaches when not evident from requirements. Searches for and studies available information and precedent designs, and develops design approaches. Makes a number of alternative scale layouts to determine feasibility of component location or construction details, whether components of required dimensions will fit into available space, and whether moving elements will clear adjacent ones. Exercises considerable ingenuity in development of arrangements; in designing supporting members of mechanical movements, and in adapting available components and materials. Exercises judgment in selecting best of several possible design layouts. Applies knowledge of accepted construction details, shop production, materials usage, agency requirements, and design practice. Calculates loads, structural strength, sizes, weights, moments, clearances, dimensional fits, and other aspects in accordance with standard formulas, criteria, and handbook tables. Works out and refers to supervisor or project engineer possible alternative compromises of conflicting requirements. Prepares or reviews detail drawings prepared by others for fabrication of item.

4. Checks and analyzes detail and assembly drawings of moderately complex items of equipment of conventional design to determine whether the design and drawings are complete and correct and whether design conforms to production requirements. Checks for proper tolerances, clearances, fits, finishes, materials, and dimensions. Performs computations and makes layouts, as required, to determine relative positions of components of intricate mechanisms. Ascertains that all information needed for production is provided in accordance with appropriate design and drafting standards. Checks that standard parts, available materials, and commercial items are used so far as practicable. Recommends changes to correct errors or nonconformance with established practice or agency standards. Develops and recommends modification of fabrication details to facilitate production. Performs final detailed review of drawings and recommends release to production.

5. Makes preliminary arrangements and prepares working plans for shipboard installation of hot and cold fresh and salt water piping, plumbing, and drainage. Using compartment plans, general and detail specifications, rated capacities, piping handbooks, knowledge of ship structure and sanitary requirements, and knowledge of shop practice, lays out complex piping systems in crowded spaces. Designs fittings and manifolds to meet special conditions. Has numerous personal contacts with other designers to clear interferences, coordinate systems, and obtain foundations for pumps. Conducts shipboard investigations to determine nature and condition of existing installations and to work out solutions to repair and alteration problems.
6. Prepares plans, specifications, and estimates for roads and airport runways including surfacing and pavements of various kinds not subject to extreme conditions of climate or loading. The requirements (e.g., load bearing capacity) are stipulated and the work involves the application of established engineering practices in designing the concrete slab, foundation, and drainage structures. Reviews standard and precedent designs and makes necessary selections and adaptations to meet specified requirements and field conditions peculiar to the locale, applies prescribed design criteria and standard and precedent specifications, and searches for current information on related design as developed by industry. In the design of runways considers suitability and availability of materials, subgrade and embankments, subbase, base courses, drainage, and pavement; considers factors such as meteorological, hydrological, topographical, and climatic features of area, soil foundations, frost susceptibility, base operation category, and use of facility.
7. Prepares plans, specifications, and cost estimates for new construction or major modification of existing electrical exterior distribution systems and interior wiring for light and power in a variety of small conventional buildings such as residences, barracks, bakeries, small shops, and offices. Computes loads and lays out distribution

systems including substations, poles, lines, and control equipment. On alteration and repair projects makes field investigations to collect data needed for design, to determine nature and condition of existing facilities, and to determine what should be done to provide, improve, or restore service under the existing conditions. Reviews comparable electrical designs prepared by engineering firms for conformance to design criteria and instructions, for accuracy and completeness, and for quality of design for practicability, economy, and suitability to functional requirements. Standards, agency guides, and instructions are generally applicable to design problems; difficult analyses and novel design requirements are typically referred to supervisor or others. and makes design changes needed to overcome indicated deficiencies or secure improvement.

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Level of responsibility

Engineering Technicians GS-9 typically work with less supervisory guidance and a greater degree of independence than at grade GS-8. In assigning work, the supervisor outlines requirements, provides information on any related work being performed, and furnishes general instructions as to the scope of objectives, time limitations, priorities, and similar aspects. The supervisor is available for consultation and advice where significant deviations from standard engineering practices must be made and he gives more detailed instructions when distinctly new criteria or new techniques are involved. (At grade GS-8 such instructions are usually provided for unfamiliar problems. Also at grade GS-8 the supervisor is typically consulted on problems not covered by guides.)

The supervisor observes the work of the GS-9 technician for progress and for coordination with work performed by other employees or other sections and for adherence to completion and cost schedules. Standard methods employed are seldom reviewed but review is made for adequacy and for conformance with established policies, precedents and sound engineering concepts and usage.

Personal work contacts typically are more frequent and demanding than at grade GS-8. They are primarily to resolve mutual problems and coordinate the work with that of personnel in related activities. Some contacts are made with using agencies for whom work is done, and with contractors and architect-engineer firms. The contacts are made, e.g., to clear up doubtful points, to advise as to discrepancies found in meeting contract terms, to consider recommendations for acceptable substitutes, and to promote adherence to agency standards and concepts of good engineering. Contacts outside the agency are usually arranged under supervisory guidance.

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ENGINEERING TECHNICIAN GS-0802-11

Nature of assignment

Engineering Technicians GS-11 perform work of broad scope and complexity that requires application of (1) demonstrated ability to interpret, select, adapt, and apply many guidelines, precedents, and engineering principles and practices which relate to the area of specialization; and (2) some knowledge of related scientific and engineering fields. GS-11 technicians plan and accomplish complete projects or studies of conventional nature requiring the independent adaptation of a general fund of background data and information and interpretation and use of precedents. They are typically confronted with a variety of complex problems in which considerable judgment is needed to make sound engineering compromises and decisions. Other related interests must often be considered, entailing frequent coordinative action with personnel in the fields concerned. There is a continuing requirement for contact work.

Initiative, resourcefulness, and sound judgment are needed in planning and coordinating phases of assignments and in selecting which of several sound alternatives is to be used in arriving at acceptable engineering compromises. Ingenuity and creative thinking are required in devising new ways of accomplishing objectives, and in adapting existing equipment or current techniques to new uses.

By comparison, technicians at lower levels receive assignments which are usually segments or phases of the type independently carried out at grade GS-11 or which involve less complex systems and facilities requiring design adaptation. GS-9 technicians apply standard engineering methods and techniques whereas GS-11 technicians are typically required to be creative in devising ways to accomplish the work.

Illustrative assignments

1. Develops cost estimates for competitive bidding for a variety of multiple-use construction projects. Determines (a) construction operations and methods involved and the time required to complete each phase or feature, (b) various types and capacities of construction equipment required and cost of operation and maintenance, (c) material types and quantities, and (d) overhead, tax, and other costs.
2. Prepares designs and specification for various utility systems such as heating, plumbing, air conditioning, ventilating, pumping, gas supply, and pneumatic control systems. Assignments characteristically involve utility systems for office buildings, technical laboratories, experimental buildings, pumping stations, and flood control facilities, here the complexity or nonconventional nature of the buildings and facilities entails design problems requiring considerable adaptation of precedents or design of features for which precedents are not directly applicable. Performs technical review of contractor-prepared designs and specifications for such systems.
3. Plans approach and details and conducts various experimental projects to develop electrical circuits equipment or breadboards of systems characterized by (a) performance requirements which are somewhat difficult to achieve because of

combinations of conflicting characteristics as versatility, reliability, size, ease of operation, and maintenance; or (b) required use of techniques or components in combinations or applications differing from previous usage. Projects may entail development of new equipment or systems, simplification and improvement of present equipment, standardization of equipment, or development of new design techniques, or methods.

In this work the technician explores available sources of information; studies and analyzes unsatisfactory characteristics of present items; determines and evaluates possible approaches with close collaboration of supervisor and others, and plans the various phases of the approach; develops electrical circuits and components; arranges for fabrication of pilot models; determines test procedures and the design of special test equipment; evaluates test results in terms of attainment of objectives; and makes design needed to overcome indicated deficiencies or secure improvement.

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Level of responsibility

GS-11 technicians have considerable freedom in planning work and carrying out assignments. The supervisor makes assignments in terms of the major objectives, providing background information and advice on specific unusual problems which are anticipated or on matters requiring coordination with other groups. Unusual or controversial problems, or policy questions arising in the course of a project, may be discussed with the supervisor but technical supervisory assistance is infrequently sought or required. The supervisor is usually informally advised regarding progress but there is little review during progress of typical assignments. Completed work in the form of recommendations, plans, designs, reports, or correspondence is reviewed for general adequacy, conformity to purpose of the assignment, and sound engineering judgment. By comparison, technicians at lower grade levels receive advice and guidance on the application of nonstandard methods and techniques or in the solution of complex problems requiring significant deviations from established practice.

GS-11 technicians customarily make contacts in the course of their work with the same groups of individuals as do technicians at lower grade levels and the purpose of the contacts are similar. Because of the increased scope of GS-11 assignments these contacts tend to become more extensive than at lower levels. Contacts with contractors and other personnel regarding complex engineering and administrative problems are carried out without close supervision. However, the technicians generally discuss with the supervisor the approach to be taken.